EOS Mission Support Network Performance Report

This is a monthly summary of EMSnet performance testing for March 2005-- comparing the measured performance against the requirements.

Highlights:

- Flows to and from LaRC and NSIDC were transitioned from EMSnet to NISN PIP in February. This transition directly and indirectly affected the ratings
  - The MRTG values for these flows are no longer available, (see description last month).
  - The “Flow” data, used in the “integrated” measurements, was collected from the LARC and NSIDC ECS routers. While useful, this data excludes formerly EMSnet flows to non-ECS destinations, such as LaTIS at LaRC, and LASP and SIDADS at NSIDC.
  - The initial problems with the transition have been fixed, and do not affect these results (as they did last month)
- The GSFC Performance Test Host (“GSFC-PTH”) was down during March, so results from GDAAC were used. The PTH node is outside the ECS firewall, and generally got higher performance than from GDAAC. The rating to EDC dropped as a result,
- The "Integrated measurements" continue to be used as the basis for the ratings (where available).
- Mostly stable performance.
- Significant changes in testing are indicated in Blue, Problems in Red

Ratings:

Rating Categories:

Rating	Value	Criteria
Excellent:	**4**	**Total Kbps** > Requirement * 3
Good:	**3**	1.3 * Requirement <= **Total Kbps** < Requirement * 3
Adequate:	**2**	:Requirement < **Total Kbps** < Requirement * 1.3
Almost Adequate:	**1.5**	Requirement / 1.3 < **Total Kbps** < Requirement
Low:	**1**	Requirement / 3 < **Total Kbps** < Requirement / 1.3
Bad:	**0**	**Total Kbps** < Requirement / 3

Where Total Kbps = Integrated Kbps (where available)
Else = User Flow + iperf monthly average

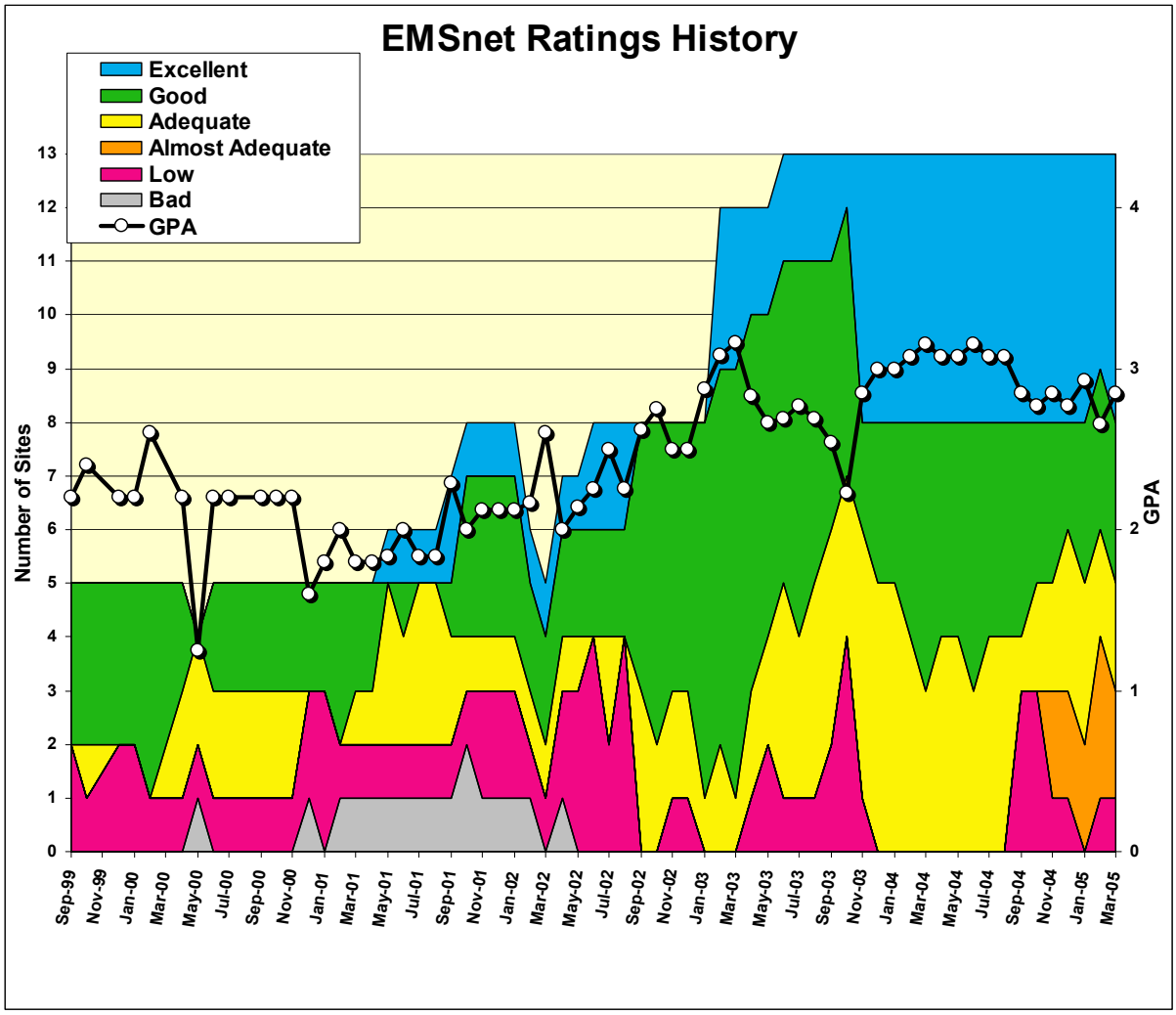
Ratings Changes:

Upgrades: ↑:

GSFC → ERSDAC: Good → **Excellent**
LaRC → JPL: Low → **Almost Adequate**
GSFC → LaRC: Almost Adequate → **Adequate**
GSFC → NSIDC: Adequate → **Good**

Downgrades: ↓:

GSFC → EDC: Almost Adequate → **Low**



The chart above shows the number of sites in each classification since EMSnet testing started in September 1999. Note that these ratings do NOT relate to absolute performance -- they are relative to the EOS requirements.

EMSnet Sites

Network Requirements vs. Measured Performance

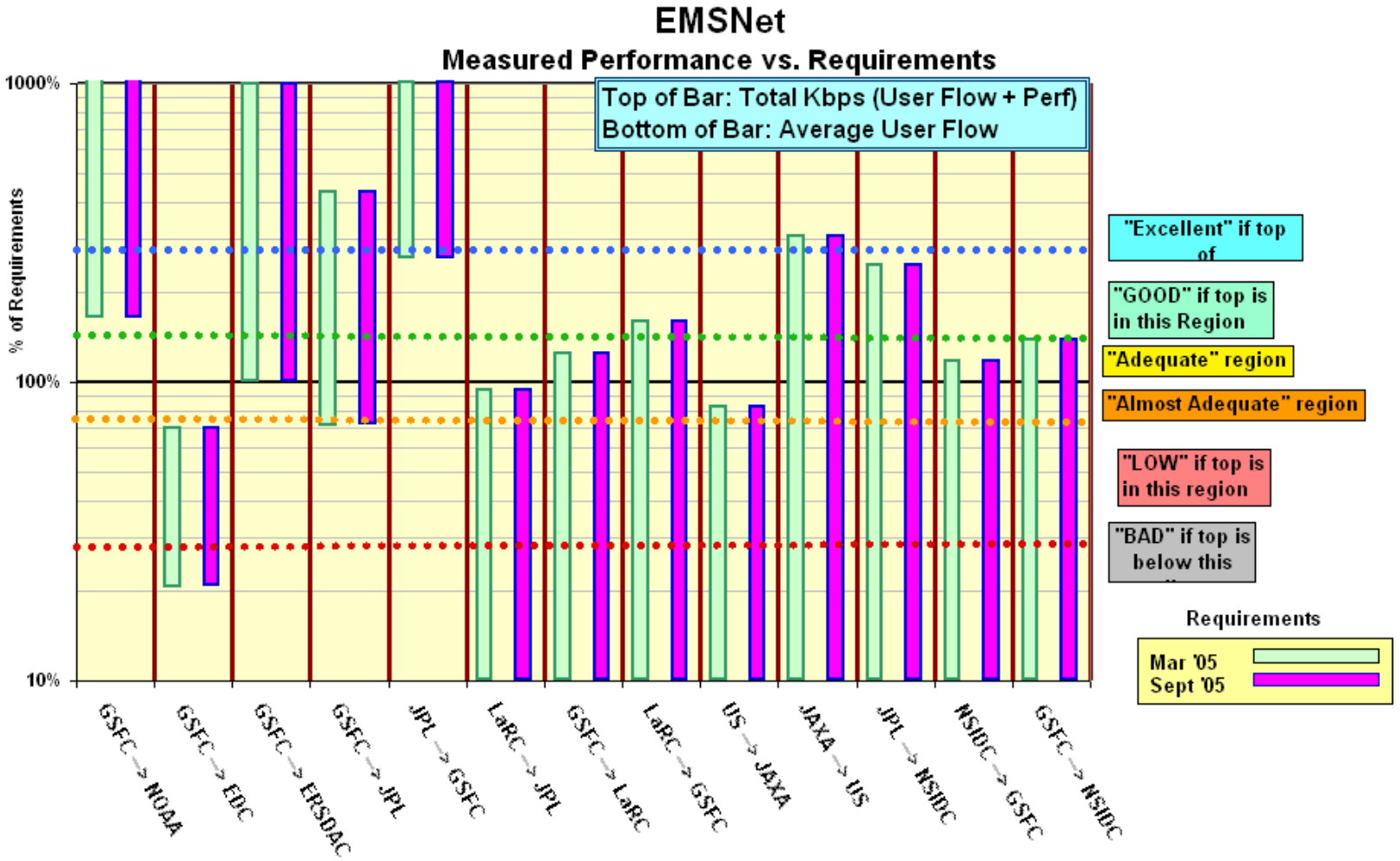
March 2005		Requirements (kbps)		Testing							
Source → Destination	Team (s)	Current Mar-05	Future Sep-05	Source → Dest Nodes	Avg User Flow kbps	iperf Avg kbps	Total Avg kbps	Integrated kbps	Rating re Current Requirements Mar-05	Rating re Current Requirements Prev	Rating re Sep-05
GSFC –> ASF	QuikScat, Radarsat	n/a	n/a	GSFC-CSAFS → ASF	7	1219	1226	1219	n/a	n/a	n/a
ASF –> JPL	QuikScat, Radarsat	n/a	n/a	ASF → JPL-SEAPAC	268	1343	1611		n/a	n/a	n/a
GSFC –> NOAA	QuikScat	189	189	GSFC-CSAFS → NESDIS	307	2929	3236	2929	Excellent	E	Excellent
GSFC –> EDC	MODIS, LandSat	285361	285361	GSFC-DAAC → EDC DAAC	58733	198820	257552	200268	LOW	A A	LOW
GSFC –> ERSDAC	ASTER	568	568	GDAAC → ERSDAC	n/a	15013	15013		Excellent	G	Excellent
GSFC –> JPL	ASTER, QuikScat, MLS, etc.	1275	1272	GSFC-CSAFS → JPL-SEAPAC	912	5380	6292	5525	Excellent	E	Excellent
JPL –> GSFC	AMSR, etc.	1155	1155	JPL-PODAAC → GDAAC	2980	8768	11748		Excellent	E	Excellent
LaRC –> JPL	TES, MISR	40311	40311	LDAAC → JPL-TES	n/a	37386	37386	38024	A A	L	A A
GSFC –> LaRC	CERES, MISR, MOPITT	58456	58456	GDAAC → LDAAC	n/a	71455	71455	72872	Adequate	A A	Adequate
LaRC –> GSFC	MODIS, TES	31695	31695	LDAAC → GDAAC	n/a	50557	50557	50568	GOOD	G	GOOD
US –> JAXA	QuikScat, TRMM, AMSR	1665	1665	GSFC-CSAFS → JAXA	64	1254	1318	1386	A A	A A	A A
JAXA –> US	AMSR	512	512	JAXA → JPL-SEAPAC	0	1590	1590		Excellent	E	Excellent
JPL –> NSIDC	AMSR	1342	1342	JPL-PODAAC → NSIDC SIDADS	n/a	3319	3319		GOOD	G	GOOD
NSIDC –> GSFC	MODIS, ICESAT, QuikScat	13326	13326	NSIDC DAAC → GDAAC	n/a	15612	15612		Adequate	A	Adequate
GSFC –> NSIDC	MODIS, ICESAT, QuikScat	64118	64118	GDAAC → NSIDC DAAC	n/a	88625	88625	88625	GOOD	A	GOOD

Notes: Flow Requirements (from BAH) include TRMM, Terra , Aqua, QuikScat, ~~ADEOS II~~

*Criteria:		
	Excellent	**Total Kbps** > Requirement * 3
	GOOD	1.3 * Requirement <= **Total Kbps** < Requirement * 3
	Adequate	Requirement < **Total Kbps** < Requirement * 1.3
	Almost Adequate	Requirement / 1.3 < **Total Kbps** < Requirement
	LOW	**Total Kbps** < Requirement / 1.5
	BAD	**Total Kbps** < Requirement / 3

Ratings Summary	Mar-05 Score	Req Prev	Sep-05 Score
Excellent	5	4	5
GOOD	3	3	3
Adequate	2	2	2
Almost Adequate	2	3	2
LOW	1	1	1
BAD	0	0	0
Total	13	13	13
GPA	2.85	2.65	2.85

This graph shows two bars for each source-destination pair. Each bar uses the same actual measured performance, but compares it to the requirements for two different times (October '04, and September. '05). Thus as the requirements increase, the same measured performance will be lower in comparison.



Interpretation: The bottom of each bar is the average measured MRTG flow to a site. Thus the bottom of each bar indicates the relationship between the requirements and actual flows. Note that the requirements include a 50% contingency factor above what was specified by the projects, so a value of 66% would indicate that the project is flowing as much data as requested. The top of each bar represents the sum of the MRTG user flow plus the iperf measurement – it is this value which is used as the basis of the ratings

1) ASF

Rating: **N/A**

Web Page: http://ensight.eos.nasa.gov/Networks/emsnet/ASF_EMS.shtml

Test Results:

Source → Dest	Medians of daily tests (mbps)					
	Best	Median	Worst	User Flow	TOTAL	Integrated
GSFC-CSAFS → ASF	1.36	1.22	0.82	0.01	1.23	1.22
ASF → NESDIS	1.28	0.86	0.24			
ASF → NSIDC	0.16	0.15	0.10			
ASF → GSFC-CSAFS	1.32	0.82	0.29			
ASF→ JPL-SEAPAC	1.26	0.89	0.47			

Comments: Thruput were stable this month to and from all destinations except for a noisy circuit March 16-23, reducing values above slightly. The 1.2 to 1.4 mbps total from is as expected for a single T1 (1.54 mbps) circuit, as is the 1.2 mbps inbound. The performance to NSIDC is still low due to the NSIDC switch from EMSnet to PIP in February (previously performance was similar to the other destinations).

Since the requirement from ADEOS has been deleted, the remaining ASF requirements are very low, and are mostly based on estimated ECS interDAAC queries, not production flows. These flow estimates are not considered reliable enough to use as a basis for testing, so the rating is "N/A".

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2) EDC:

Rating: ↓ Almost Adequate → **Low**

Web Page: http://ensight.eos.nasa.gov/Networks/emsnet/EDC.shtml `

Test Results:

Source → Dest	Medians of daily tests (mbps)					
	Best	Median	Worst	User Flow	TOTAL	Integrated
G-DAAC→ EDC LPDAAC	218.5	198.8	98.2	68.8	257.6	200.3
GSFC-PTH → EDC PTH	n/a	n/a	n/a			
ERSDAC→ EDC	6.5	5.6	4.1	(via APAN / Abilene / vBNS+)		
EDC → GSFC	121.6	111.0	74.9			

Requirements:

Source → Dest	Date	mbps	Rating
GSFC→ EDC	FY '05	285.4	Low
ERSDAC→ EDC	FY '05	20	Bad

Comments:

The rating this month is based on testing between the GSFC DAAC and the EDC DAAC. The usual tests between the GSFC and EDC performance test host was not used this month because the GSFC-PTH was down (it has been restored in April, and will again be used as the basis for this rating). The PTH hosts are outside the EDC firewalls, and therefore have higher thruput. The lower thruput between the DAACs is the cause of the lower rating – network performance was essentially stable.

The rating is based on the "Integrated" measurement, and as usual is lower than the sum of the MRTG and iperf. The user flow this month had only a very small contribution to the integrated measurement. This 200 mbps value is now below the requirement / 1.3, so the rating drops to "Low".

The poor results from ERSDAC to EDC-PTH (in support of the planned ERSDAC to EDC ASTER flow, replacing tapes), together with the much better performance in the opposite direction, shows that there is a peering problem between Abilene and vBNS+ in DC, in the Abilene to NGIX-E connection. **This problem has been cleared up in April!** The 20 mbps requirement is approximate, based on EDC estimates.

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3) JPL:

Ratings: GSFC → JPL: Continued **Excellent**
JPL → GSFC: Continued **Excellent**
LaRC → JPL: ↑ Low → **Almost Adequate**

Web Pages:

http://ensight.eos.nasa.gov/Networks/emsnet/JPL_SEAPAC.shtml
http://ensight.eos.nasa.gov/Networks/emsnet/JPL_PODAAC.shtml
http://ensight.eos.nasa.gov/Networks/emsnet/JPL_TES.shtml
http://ensight.eos.nasa.gov/Missions/terra/JPL_MISR.shtml

Test Results:

Source → Dest	Medians of daily tests (mbps)					
	Best	Median	Worst	User Flow	TOTAL	Integrated
GSFC-CSAFS → JPL-SEAPAC	6.2	5.4	2.6	0.9	6.3	5.5
GSFC-MODIS → JPL-PODAAC	4.6	3.4	0.7	0.9	4.3	3.7
LaRC DAAC → JPL-TES	40.5	37.4	22.8	N/A		
LaRC DAAC → JPL-MISR	40.9	37.6	22.6			
LaRC PTH → JPL-PTH	N/A	N/A	N/A			
JPL-PODAAC→ GSFC DAAC	12.3	8.8	2.7	3.0	11.8	

Requirements:

Source → Dest	Date	Mbps	Rating
GSFC → JPL combined	March '05	1.60	**Excellent**
JPL → GSFC combined	March '05	0.63	**Excellent**
LaRC DAAC → JPL-TES	March '05	30.6	**Adequate**
LaRC DAAC → JPL-MISR	March '05	18.5	**Good**
LaRC DAAC → JPL-Combined	March '05	40.3	**Almost Adequate**

Comments:

GSFC → JPL: Performance on this circuit has been mostly stable since the BOP switchover on 15 August '02; well above the requirement; the rating remains "Excellent". The "integrated" data is (like most other sites) just slightly higher than the iperf results alone, and lower than the sum of the median iperf and average MRTG. This again indicates that adding a small average user flow to the median iperf overstates the true situation.

LDAAC→ JPL: This flow was switched to NISN PIP on 10 Feb, and thruput initially dropped to 10 mbps. Also, MRTG data became unavailable at that time. Thruput improved to 28 mbps on 14 Feb, then recovered fully to 40 mbps on 26 Feb, increasing the combined (TES + MISR) rating back to "Almost Adequate". The LaRC-PTH to JPL-PTH testing also was disabled by this transition, since the LaRC-PTH node switched to PIP, while JPL-PTH remained on EMSnet, and thus did not have connectivity.

Note:the MISR requirement is open to some interpretation. The formal QA flow is only 9.7 mbps – this value is used to generate the "combined" requirement. But the science data also flows on the same circuit. This would push the total MISR flow requirement to 18.5 mbps, and the total LaRC → JPL requirement to 49.1 mbps, which is higher than the circuit speed. This configuration is based on a management decision to reduce cost, in the expectation that both projects' requirements are bursty and include contingency. Thus the actual requirements of both projects are expected to be met with this circuit capacity.

JPL → GSFC: The requirement from JPL to GSFC includes flows from NASDA and ASF which go via JPL, and includes GSFC and NOAA destinations. Since many of these flows were related to ADEOS, this requirement dropped substantially with the removal of ADEOS. The combined requirement is now only 0.63 mbps, and the combined 12.5 mbps thruput is more than 3 times that, so the rating remains "Excellent".

4) NSIDC:

Ratings: GSFC → NSIDC: ↑ Adequate → **Good**
NSIDC → GSFC: Continued **Adequate**

Web Page: http://ensight.eos.nasa.gov/Networks/emsnet/NSIDC_EMS.shtml

GSFC ←→ NSIDC Test Results:

Source → Dest	Medians of daily tests (mbps)			
	Best	Median	Worst	Integrated
GSFC-DAAC → NSIDC	91.4	88.6	40.9	88.6
NSIDC → GSFC-DAAC	17.0	16.9	12.7	

Requirements:

Source → Dest	Date	Mbps	Rating
GSFC → NSIDC	March '05	64.1	Good
NSIDC → GSFC	Dec '04	13.3	Adequate

Comments:

GSFC → NSIDC: This flow was switched from EMSnet to NISN PIP on 8 February. Thruput initially dropped (to a peak of 80 mbps), but recovered a week later. The rating is now based on testing from G-DAAC to the NSIDC DAAC (The GSFC-PTH node was down this month – but has recovered in April. Also, as a result of this switch, the MRTG data became unavailable at that time. The iperf and integrated thruput values increased slightly this month, and is now 30% above the requirement. (The requirement varies from month to month, based on planned ICESAT reprocessing. This month the reprocessing is NOT included, reducing the requirement from 79 mbps in December '04.) So the rating improves to "Good".

NSIDC → GSFC: Performance from NSIDC to GSFC was stable this month, and remains slightly below 30% above the requirement, so the rating remains "Adequate".

Other Testing:

Source → Dest	Medians of daily tests (mbps)				
	Best	Median	Worst	Requirement	Rating
JPL → NSIDC-SIDADS	3.77	3.32	2.33	1.34	Good
GSFC-ISIPS → NSIDC (iperf)	90.2	89.7	67.4		
GSFC-ISIPS → NSIDC (ftp)	22.0	21.9	15.9		
NSIDC → GSFC-ISIPS (iperf)	16.1	15.6	15.2		
ASF → NSIDC	0.16	0.15	0.10	0.73	Bad

Comments:

JPL → NSIDC-SIDADS: This flow switched from EMSnet to PIP on Feb 8, and thruput dropped from 6.1 mbps previously. Thruput remains below 3 x the requirement, so the rating remains "Good".

GSFC-ISIPS ← → NSIDC: Performance from ISIPS to NSIDC was fixed on 8 February, after having problems since July '04. Performance is at nominal levels for the circuit capacity. Testing from NSIDC to ISIPS is stable and gets very similar thruput as NSIDC to GDAAC.

ASF → NSIDC: The median thruput dropped with the switch to PIP last month (was 1.4 mbps). It remains at less than 30% of the requirement, so the rating remains "Bad".

5) GSFC ←→ LaRC:

Ratings: LDAAC → GDAAC: Continued **Good**
GSFC → LARC: ↑ Almost Adequate → **Adequate**

Web Page: http://ensight.eos.nasa.gov/Networks/emsnet/LARC.shtml

Test Results:

Source → Dest	Medians of daily tests (mbps)			
	Best	**Median**	**Worst**	**Integrated**
GDAAC → LDAAC	78.4	71.5	27.0	72.9
GSFC-NISN → LaTIS	79.1	61.9	11.9	
LDAAC → GDAAC	51.1	50.6	25.0	50.6

Requirements:

Source → Dest	Date	Mbps	Rating
GSFC → LARC (Combined)	FY '05	58.5	**Adequate**
GDAAC → LaRC ECS	FY '05	17.8	**Excellent**
GSFC → LATIS	FY '05	40.7	**Good**
LDAAC → GDAAC	FY '05	31.8	**Good**

Comments:

GSFC → LaRC: The GSFC→ LaRC ECS DAAC flow was switched from EMSnet to NISN PIP on 8 February (GSFC → LaTIS had been flowing on PIP since November). The combined 58.5 mbps requirement had been split as indicated above when the flows were on separate circuits, but is now treated as a single requirement as they are now both on PIP. So the rating is now based on the GDAAC to LaRC ECS DAAC thruput, compared to the combined requirement.

Initially, the PIP PVC was not increased to accommodate the increased load, and thruput to ECS dropped. The PVC was increased in late February so performance was better in March. MRTG and LaTIS user flow data are also no longer available (but the ECS user flow data was restored in March).

So for March, the GSFC→ LaRC ECS DAAC thruput is now above the combined requirement, but by less than 30%, so the combined rating improves from "Almost Adequate" to "Adequate".

LaRC → GSFC: Performance remained stable with the switch to PIP. The requirement jumped from 6.8 mbps to 31.7 mbps in Oct '03, to incorporate this backhaul of all LaRC science outflow via GSFC (which is no longer planned, however, due to the switch from EMSnet to PIP). The thruput is more than 30% above this requirement, so the rating remains "Good".

6) NOAA NESDIS:

Rating: Continued **Excellent**

Web Page: http://ensight.eos.nasa.gov/Networks/emsnet/NOAA_NESDIS.shtml

Test Results:

Source → Dest	Medians of daily tests (mbps)					
	Best	**Median**	**Worst**	**User Flow**	**TOTAL**	**Integrated**
GSFC-CSAFS → NESDIS	2.93	2.93	1.61	0.31	3.24	2.93
GSFC-CSAFS → NESDIS via MAX	7.15	6.93	4.26			
ASF → NESDIS	1.28	0.86	0.24			
JAXA (NASDA) → NESDIS	1.42	1.28	0.42			
JPL → NESDIS via MAX	3.39	3.07	2.17			

Requirements:

Source → Dest	FY	Mbps	Rating
GSFC-CSAFS → NESDIS	'05	0.19	**Excellent**

Comments: The dominant flow to NOAA is Quikscat data, from GSFC CSAFS.

Like other sites, the "Integrated" results are lower than the sum of the median iperf and average MRTG In this case the 3.24 mbps total iperf + user flow again exceeds the 2 x T1 circuit capacity, providing strong evidence that the integrated results are more accurate. Since the integrated thruput is more than 3 times the FY '05 requirement, the rating remains "Excellent".

Note that the flow from JAXA is limited by the TCP window size of the JAXA test source, and the long RTT.

Results from GSFC SAFS to NOAA, via MAX (instead of EMSnet) were also stable, about double the EMSnet performance. Results from JPL, via Abilene to the MAX increased a little, but were still lower than expected.

7) US ←→ JAXA:

Ratings: JAXA → US: Continued **Excellent**
US → JAXA: Continued **Almost Adequate**

Web Pages http://ensight.eos.nasa.gov/Networks/emsnet/JAXA_EOC.shtml
http://ensight.eos.nasa.gov/Networks/emsnet/JPL_SEAPAC.shtml
http://ensight.eos.nasa.gov/Networks/emsnet/GSFC_SAFS.shtml

Test Results:

Source → Dest	Medians of daily tests (mbps)					
	Best	Median	Worst	User Flow	TOTAL	Integrated
GSFC-CSAFS → JAXA-EOC	1.53	1.25	0.74	0.06	1.31	1.39
JAXA-EOC → JPL-SEAPAC	1.61	1.59	0.75	0.01	1.60	
JAXA-EOC → GSFC-CSAFS	1.46	1.31	0.53			

Requirements

Source → Dest	Date	mbps	Rating
GSFC → JAXA	FY '05	1.67	Almost Adequate
JAXA → US	FY '04, '05	0.51	Excellent

Comments:

US → JAXA: The requirements above were reduced in November '03, due to the removal of ADEOS flows. They have again been reduced in January '05 (were 2 mbps previously).

Performance has been stable since it recovered on January 13 (thruput had dropped on November 27 to below 1.0 mbps). The rating remains "Almost Adequate".

Notes:

- This case has the integrated thruput is again slightly HIGHER than the sum of the the iperf and MRTG – this indicates a problem with the data collection process.
- The requirement still includes 4 ISTs at JAXA for AMSR-E. Each IST has a requirement for 311 kbps, for a total of 1244 kbps. It could be questioned whether JAXA intends to operate all four of the ISTs simultaneously, or whether some ISTs are backups, in which case the network requirements would be reduced to a lower value.

JAXA → US: Performance remained consistent with the reduced ATM PVC. The requirement was reduced in November '03 due to the removal of ADEOS requirements. The rating remains "Excellent".

Note: JAXA has not yet implemented testing with multiple tcp streams, so performance to GSFC is limited by the TCP window size on JAXA's test machine, in conjunction with the long RTT. In order to reflect the actual capability of network, the rating is derived from testing from JAXA to JPL, which uses the same Trans-Pacific circuit, but has a shorter RTT, so will not be limited by the TCP window size. The Trans-Pacific circuit connects into the higher speed domestic EMSnet at JPL, which is not expected to be the limiting factor.

8) ERSDAC ← → US:

Rating: ↑ Good → **Excellent**

Web Page :http://ensight.eos.nasa.gov/Networks/emsnet/ERSDAC.shtml

Test Results:

Source → Dest	Medians of daily tests (mbps)			
	Best	Median	Worst	User Flow
GDAAC → ERSDAC (via APAN)	21.9	15.0	5.5	N/A
GSFC ENPL → ERSDAC (via APAN)	89.4	89.2	18.8	

Requirements:

Source → Dest	FY	Kbps	Rating
GSFC → ERSDAC	'03 - '05	568	**Excellent**

Comments: Dataflow from GDAAC to ERSDAC was switched to APAN in late February, and the performance above is via that route. MRTG and user flow data are no longer available due to this switch.

The thruput from GDAAC is apparently limited by packet loss at the GigE to FastE switch at Tokyo-XP. The GigE GDAAC source does not see any bottlenecks until this switch (The Abilene and APAN backbones are 10 Gbps), and thus exceeds the FastE output capacity. But the FastE connected GSFC-ENPL node is limited to 100 mbps by its own interface, so does not suffer performance degrading packet loss – it's performance is much higher. Note: EDOS is also FastE connected, and gets the higher performance levels.

The requirement will be revised to include the level 0 flows which used to be sent by tapes, but this value is not known at this time, so the old (primarily ICC) value is used here. Thus the rating improves to "Excellent".

Other Testing: .

Source → Dest	Medians of daily tests (mbps)		
	Best	Median	Worst
ERSDAC → GSFC-PTH	N/A	N/A	N/A
ERSDAC → JPL-ASTER IST	87.9	87.9	68.1
ERSDAC → EDC	6.5	5.6	4.1

Performance from ERSDAC to GSFC-PTH was not tested this month, because GSFC-PTH was down. Previously it was very good (close to 90 mbps, limited by the ERSDAC FastE connection).

Problems are evident from ERSDAC to EDC via APAN (planned for L1 data flow). In this case investigation has determined that the problem is packet loss in the Abilene – vBNS+ peering in DC, specifically, in the Abilene to NGIX-E circuit. **Note: This problem has been fixed in April!**

A new test has been added this month, from ERSDAC to the JPL ASTER IST, via APAN. The results are much higher than previously via the 1 mbps ATM circuit, and should be considered "Excellent"